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August 1982

Dear Floodplain Administrator:

This comprehensive bibliography is an attempt to identify and compile information pertaining to floodplain management in Montana. Its purpose is twofold--first, to provide a single point of reference for information on floodplain management, and second, to aid floodplain administrators in selecting management planning needs and priorities. We hope that making this information easier to find and obtain will increase all of our abilities to make well-informed and responsible decisions for guiding development in our floodplains.

Although every attempt has been made to provide you with a comprehensive and up-to-date reference work, it is possible, albeit probable, that some important sources of information were omitted from this bibliography. In this light, we would be very grateful if you would bring any obvious omissions to our attention. Please contact the Floodplain Management Section, DNRC, 32 S. Ewing, Helena, MT 59620.

Respectfully,

Timothy S. Pool

Timothy S. Pool
NFIP State Coordinator

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# RESOURCE BIBLIOGRAPHY

# FOR FLOODPLAIN MANAGEMENT

# IN MONTANA

Prepared by the

Floodplain Management Section

John Hamill, supervisor

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Montana Department of Natural Resources and Conservation

32 S. Ewing

Helena, MT 59620

ABSTRACT

Publications addressing floodplain management, planning, and regulations which are or may be pertinent to Montana are listed and, in most cases, briefly described.

DISCLAIMER

The work that provided the basis for this publication was supported by funding under a cooperative agreement with the Federal Emergency Management Agency. The substance and findings of this work are dedicated to the public. The author is solely responsible for the accuracy of the statements and interpretations contained in this publication. Such interpretations do not necessarily reflect the views of the Government.

# PREFACE

Government, public, and private entities have produced floodplain management information at an unprecedented rate over the past several years. Nevertheless, for floodplain managers and administrators, the task of searching for that information generally has remained as tedious and time consuming as ever. This is so at a time when government agencies are required to make increasingly difficult and important decisions that will affect the lives of their constituents and their communities. Thus, access to available information has become all but critical.

The Floodplain Management Section of the Montana Department of Natural Resources and Conservation produced this bibliography to make information on floodplain management in Montana and the other states easier to find. We hope the information presented here will make floodplain administrators throughout the state more aware of the information that is available to them, and that the decisions they make based on this information will make Montana a leader in floodplain management.

ACKNOWLEDGMENTS

This bibliography was produced as part of a cooperative agreement by the Floodplain Management Section, Montana Department of Natural Resources and Conservation (DNRC), and the Federal Emergency Management Agency. Thanks go to: Tim Pool, NFIP coordinator for Montana, for coordinating research and compiling this bibliography; Cindy Forgey and Marjorie Peterson, DNRC, for processing the text; and William Phippen, DNRC, for editing.

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## I. CASE HISTORIES OF STATES AND COMMUNITIES

Evaluation of Economic, Social, and Environmental Effects of Floodplain Regulations. Sheaffer & Roland, Inc., consultants. HUD, Office of Policy Development and Research, Washington, D.C. U.S. Government Printing Office. 1981.

Economic, social, and environmental effects of floodplain regulations on twenty-three communities are discussed.

Flood-Prone Areas and Land-Use Planning; Selected Examples fromthe San Francisco Bay Region, California. Waanenen, A.O., Limerinos, and Kockelman, W.J. U.S.G.S. and HUD Office of Policy Development and Research, Washington, D.C. U.S. Government Printing Office. 1977.

Floodplain planning, management, and regulations in the San Francisco Bay region are reviewed.

Long Hollow Creek Channel Clearing, Nez Perce, Idaho (Draft Environmental Impact Statement). Army Engineer District, Walla Walla, Washington. National Technical Information Service, PB-205 676D. 1972.

Clearing and reshaping 5,000 feet of Long Hollow Creek will protect Nez Perce from normal spring runoff. The project will require dredging, create spoil banks, and cause more seasonal erosion downstream.

Long Hollow Creek Channel Clearing, Nez Perce, Idaho, (Final Environmental Impact Statement). Army Engineer District, Walla Walla, Washington. National Technical Information Service, EIS-ID-72-4562-F. 1972.

Clearing, shaping, and reseeding 5,000 feet of Long Hollow Creek will prevent flood damage to Nez Perce, Idaho. The project will also make the creek look less natural and erode its banks more. Alternatives and public comment are included.

Environmental Statement on Almont Flood Control Project Measure, Lewis and Clark 1805 RC and D Project, North Dakota (Final EnvironmentalImpact Statement). Soil Conservation Service, Washington, D.C. National Technical Information Service, PB-199 655F. 1971.

Almost three miles of dikes, diversions, and channel will protect Almont from the 100-year flood. The project will also isolate about 6,100 feet of Big Muddy Creek and lessen the area's natural beauty. Five alternatives were considered.

Pilot Planning Study for Area-Wide Storm Drainage Planning. Volumes I and II. Wright-McLaughlin Engineers, Denver, Colorado. 1969.

North Boulder, Colorado, served as a pilot study of a method for planning regional storm drainages, of financing strategies, of the"Urban Storm Drainage Criteria Manual," and of drainage alternatives. Volume One contains text; Volume Two contains drawings.

Flood Plain Information: Colorado River-Onion Creek to Montopolis Bridge, Austin, Texas. Army Engineer District, Fort Worth, Texas. 1976.

Colorado River floodplains are primarily rural, but may be developed. Large floods and serious damage may occur.

Boulder, Colorado: A Study in Growth. Flack, J.E. University of Colorado, Boulder. In "Man and the Quality of His Environment: Western Resources Conference," pp. 223-229. 1968.

Conference participants discussed preserving the natural environment in the face of urbanization. Boulder has dealt well with most of its environmental problems, especially water supply and air pollution. Water pollution and transportation will be addressed soon. Flood management needs immediate action.

Pilot Study in Flood Plain Management. Mueller, A.C., and Hoffman, J.E. Washington State University, Pullman. In "Hydraulic Engineering and the Environment: Proceedings of the 21st Annual Hydraulic Division Specialty Conference," pp. 113-120. ASCE, New York. 1973.

A scale model of one mile of the river flowing through Pullman, Washington, was built. The model was then used to study the effects of various flow levels, obstructions, and floodplain management efforts, as well as to provide a visual overview of flooding problems.

Water Resources Development by the U.S. Army Corps of Engineers in Utah: 1975. U.S. Army Corps of Engineers, South Pacific Division, San Francisco, California. 1975.

Report on Corps of Engineers' flood control and management activities in Utah. Authority, water resources development, and investigations also are discussed.

Flood Plain Management for Oregon Cities and Counties. University of Oregon, Eugene Bureau of Governmental Research and Service, School of Community Service and Public Affairs, Planning Bulletin Number 10. Rev. 1978.

Most flood-prone land is good for something, but uses especially vulnerable to flood damage should be prohibited. Local governments are most able to control land use through their control of building permits and zoning. They may, however, need technical assistance.

Record Floods in Southwest Virginia, April 1977. Virginia State Water Control Board, Richmond, and Virginia Office of Emergency Services, Richmond. Information Bulletin 527. June 1977.

Ten southwestern Virginia counties suffered the worst floods in their history during spring 1977. Damages are assessed and recommendations for flood management include land-use regulations, state and federal aid to communities, and public education campaigns.

Methodology for Evaluation of Feasibility: Multijurisdictional Urban Drainage and Flood Control Projects. Urban Drainage and Flood Control District, Denver, Colorado. National Technical Information Service, PB-292 576. 1977.

This method for judging the feasibility of urban flood control in Denver, Colorado, emphasizes damage reduction by non-structural measures. The method involves cost/benefit analyses of damage reduction, description of other benefits, and trade-offs between the two.

Indiana Five-Year Water Resources Research and Development Plan, Fiscal Years 1982-1986. Water Research Center, Purdue University, Lafayette, Indiana. National Technical Information Service. 1980.

Indiana generally receives ample water through precipitation. But unpredictable variations in precipitation pose problems. Indiana's water resource problems fall into six categories, which are, in turn, divided into fifty-three research priorities.

Water Resources Research Five-Year Plan/1982-1987. Lubka, L. North Dakota Water Resources Research Institute, Fargo. National Technical Information Service, PB81-124497. 1980.

Study of North Dakota water resources identifies eight problem areas and seventeen research priorities. The first priority with regards to both the seriousness of the problem and the state's ability to offer solutions, is floodplain management.

Expanded Flood Plain Information Study Willow, Alaska. Army Engineers District, Anchorage, Alaska. 1980.

Hydrologic information and floodplain regulatory policies for the site of Alaska's new capital city were evaluated using a computerized data management and analysis system. Flooding will increase as a result of development, but certain construction measures can reduce its effects.

Floodplain Regulation in Ontario: An Analysis of Existing and Proposed Policy in the Grand and Credit River Watersheds. Gardner, J., and Mitchell, B. Department of Geography, University of Waterloo, Ontario. Journal of Environmental Management 11 (1980), pp. 119-131.

Floodplain management in Ontario since 1940 is reviewed. 1977 changes in the program divide floodplains into "floodways" and "flood fringes." Greater development is allowed in flood fringes, jurisdictional problems arise. Another problem is that financial arrangements favor development in flood-prone areas.

Handbook for a Flood Plain Management Strategy. Zensinger, Larry; McClure, Gary; and Faulkner, Pat. East-West Gateway Coordinating Council, St. Louis, Missouri. HUD, St. Louis. 1974.

The flood of 1973 shows the need for regional and local flood management policies. Flooding is described, and solutions suggested. The National Flood Insurance Program is also explained.

Five-Year Water Resources Research Plan: 1982-1987. Dougal, M.D., and Austin, T.A. Iowa State Water Resources Research Institute, Ames. National Technical Information Service, PB81-231938. 1980.

Iowa may face a water shortage in the next forty years. The major sources of the problem are agriculture, power generation, and sedimentation. Iowa's water resources are evaluated.

Stream Maintenance to Reduce Flooding. Hougue, R.W. Decatur City Engineer, Decatur, Illinois. Public Works 112 (1981), pp. 44-45.

Removing natural and man-made obstructions from two creeks in Decatur, Illinois, has decreased flood danger. Continued maintenance is essential.

Guidelines for Establishing Economic and Engineering Flood Criteria. Crutchfield, J.A., and Hopkins, G.F., University of Washington, Seattle; and Barkley, P.W., et al., Washington State University, Pullman. Washington Department of Water Resources, Olympia. 1970.

Flood control efforts by the state of Washington, are evaluated. Ways to improve these efforts are suggested.

Floodplain Services Available from the Illinois State Water Survey. Lardner, John P.; Alexander, James L.; and Terstrep, Michael L. Illinois State Water Survey. Illinois Institute of Natural Resources, Urbana. 1979.

The services of the Illinois State Water Survey and their availability to the public are described.

Rules and Regulations of the Department of Natural Resources Relating to Statewide Standards and Criteria for Management of Flood Plain Areas of Minnesota. Minnesota Department of Natural Resources, St. Paul. 1970.

Minnesota statutes prescribe minimum standards and criteria for floodplain management.

Minnesota: Status of Floodplain Management. Minnesota Department of Natural Resources, Land Use Management Section, Division of Waters, St. Paul. 1978.

The Status of Floodplain Management in the North Dakota. Meyers, Mary F. North Dakota State Water Commission, Bismarck. 1981.

In an effort to educate the public, floodplain management in general and in North Dakota is discussed.

Nebraska Floodplain Management Program -- Part I. Mathews, Albert E. Nebraska Natural Resources Commission, Lincoln. ASCE J Hydraulics Division 101 (1975), pp. 977-982.

The 1967 Nebraska Floodplain Regulation Act authorized floodplain delineation and land-use regulation by the state. Local governments have administrative responsibility for the regulations.

Nebraska Floodplain Management Program -- Part II. Cook, James P. Nebraska Natural Resources Commission, Lincoln. ASCE J Hydraulics Division 101 (1975), pp. 983-987.

Regulations imposed by Nebraska's Floodplain Regulation Act have met with social, political, and legal problems. The regulations must be uniformly applied, especially those that concern compensation to property owners.

Development of Floodplain Management for Fort Collins, Colorado -- A Case Study of U.S. Practice. Pilgrim, D.H., and, Burns, R.A. University of New South Wales, Sydney, Australia. In "National Conference Public Institute of Engineering, Australia": 76/2, pp. 5-9. 1976.

Floodplain management in Fort Collins provides a case study of the national program in the U.S. over a ten-year period (1966-1976). Methods and problems in implementing regulations are discussed.

Floodplain Management in Dallas, Texas: 1908-1978. McCorkie, Monroe, and Halff, Albert H. Department of Public Works, Dallas, Texas. ASCE J Hydraulics Division 105 (1979), pp. 125-137.

Rapid urban development has caused serious flooding problems inDallas, Texas. Its flood management program emphasizes carefuldelineation and specific response to each drainage, public ownership andmultiple use of flood lands, and visual quality.

Floodplain Management: Administrative Problems and Public Responses. Baur, E.J., and Welier, J.M. Kansas Water Resources Research Institute, Manhattan. National Technical Information Service PB80-128895, contribution No. 206. 1979.

The Flood Disaster Protection Act of 1973 authorizes for communities to adopt a flood control program that combines land-use regulations with government-sponsored insurance. Most medium-sized cities in four midwestern states are involved in the program, but many are critical of it.

Floodland and Shoreland Development Guide. Southeastern Wisconsin Regional Planning Commission, Waukesha. Planning guide No. 5, #968.

Water Resource problems and solutions are described for local governments in Wisconsin. Urban problems and comprehensive regional planning are stressed.

A Three-Directional Approach to Floodplain Management: Minnesota Experiences. Wright, J.M. Minnesota Department of Natural Resources, St. Paul. Paper presented at the National Conference of Floodplain Management, Washington, D.C. July 24, 1974.

In 1969, Minnesota's Floodplain Management Act required all cities and counties to adopt floodplain management regulations in order to reduce flood damage. The state, in cooperation with federal and local agencies, helped provide information and data.

The Effects of Land Use Change on the Hydrology of an Urban Watershed. Wallace, J.R. School of Civil Engineering, Georgia Institute of Technology, Atlanta. National Technical Information Service PB-206 426. Environmental Resources Center, Georgia Institute of Technology completion report ERC-0871. 1971.

Changing land-use patterns along two streams in Atlanta, Georgia, have changed water runoff patterns. Base flows in wet months have decreased, however, and storm floods in dry months threaten to be as large as winter and spring floods.

Flood-Proofing Administration Manual for Minnesota. U.S. Army Corps of Engineers, St. Paul, and Minnesota Department of Natural Resources, Division of Waters, St. Paul. 1977.

Reducing Flood Damages by Acquisition and Relocation: The Experiences of Four Minnesota Communities. Minnesota Department of Natural Resources, Division of Waters, St. Paul.

## II. FEDERAL PROGRAMS AND NATIONAL ISSUES

Coordination During Flood Insurance Studies, Community Assistance Series No. 2. HUD-FIA, Washington, D.C. U.S. Government Printing Office. 1979.

Help is given to local officials and citizens of communities with flood hazards where flood insurance studies will be performed.

Entering the Regular Program, Community Assistance Series No. 3. HUD-FIA National Flood Insurance Program, Washington, D.C. U.S. Government Printing Office. 1978.

FIA's procedures and communities' rights, responsibilities, and preparation to enter the permanent, "Regular Program" phase of the National Flood Insurance Program are described.

The Floodway: A Guide for Community Permit Officials, Community Assistance Series No. 4. FEMA-FIA, Washington, D.C. U.S. Government Printing Office. 1979.

Definitions and explanations of terms and regulations to be used by permit officials monitoring floodplain development are provided.

Matewan Local Protection and Floodproofing, Tug Fork, Big Sandy River, West Virginia (Draft Environmental Impact Statement). Army Engineer District, Huntington, West Virginia. 1972.

Levees, floodwalls, and floodproofing of residences will decrease flood damage in Matewan, West Virginia. The project will also require resettling some residents, look unpleasant, and cause disturbance during construction.

Guide for Ordinance Development, Community Assistance Series No.1 (a-d). HUD-FIA National Flood Insurance Program, Washington, D.C. U.S. Government Printing Office. 1978.

Guidelines are provided for communities in the Regular and Emergency phases of the National Flood Insurance Program, both with and without floodway maps.

Corps' New Look in Flood Control: No Dams, Levees. Zeldin, M. Audubon 77 (1975), pp. 103-104.

The Water Resources Development Act is changing the Corps of Engineers' policy by requiring it to consider nonstructural flood management techniques. Environmentalists will have a chance to affect the Corps'plans. Examples in Wisconsin, Massachusetts, and Colorado show the new policy at work.

Questions and Answers, National Flood Insurance Program. FEMA-FIA Washington, D.C. 1980.

How to Read a Flood Insurance Rate Map. HUD-FIA, Washington, D.C. 1977.

How to Read Flood Hazard Boundary Maps. HUD-FIA 149(2), Washington, D.C. 1976.

Flood Hazard in the United States: A Research Assessment. White, G.F. Institute of Behavioral Science, University of Colorado, Boulder. National Technical Information Service PB-262 023. 1975.

U.S. flood distribution, changes in floodplains, effects on the nation, national forces' effect on flood management, and the 1972 flood in Rapid City, South Dakota, are discussed. New research could improve the efficiency of flood management.

Policy and Program Analysis of an Open Land Approach to Flood Plain Management. Royer, Jack P.; Wilkins, Bruce T.; and Allee, David J. Center for Environmental Research, Cornell University, Ithaca, New York. Office of Water Research and Technology, Washington, D.C. 1978.

Flood management in the United States tends away from construction and towards land-use planning. New emphasis leads to using floodplains as parks and open space. The Susquehanna River Basin of southern New York State shows relevant land use patterns, economics, and politics.

Flood Hazard Mitigation. Ackermann, C. National Science Foundation, Washington, D.C. 1980.

New approaches to nationwide flood problems are needed. Discussion includes the nature, causes, distribution, and trends of floods. Public reaction and flood management are also surveyed.

Flood Insurance Program: Regional Agency's Perspective. Walesh, Stuart G., Donohue & Associates, Inc., Waukesha, Wisconsin. J. Water Resources Planning Management Division ASCE 105 (1979), pp. 243-257.

The National Flood Insurance Program has worked well on the national level, but hampered some state and local efforts. The program's strong and weak points, as well as measures for improving it, are discussed.

Guidelines for Determining Flood Flow Frequency. Hydrology Committee. U.S. Water Resources Council, Washington, D.C. 1976.

These procedures for defining flood dangers are needed in the federal program to reduce flood damage.

Turning Point. Bernstein, George K. Water Spectrum 6 (1974), pp. 8-14.

The Flood Disaster Protection Act of 1973 forces flood-prone communities to practice floodplain management. It also improves the 1968 Flood Insurance Program.

Alternatives for Standards and Regulations. Mrazik, Brian R., and Krimm, Richard W. HUD, Washington, D.C. In "Proceedings of the Engineering Foundation Conference on Improved Hydrological Forecasting -- Why and How," pp. 375-386. ASCE, New York. 1980.

Regulations of the National Flood Insurance Program place occupancy and construction requirements on participating communities. Some regulations may need to be changed. Also engineers providing data for program administration may face new demands.

Urban Flood Management: Problems and Research Needs. Howells, David H. North Carolina State University at Raleigh. ASCE J Water Resources and Planning Management Division 103 (1977), pp. 193-212.

A 1975 panel on urban flood management discussed and reached conclusions regarding many subjects, including federal goals, policies, and actions in relation to state and local interests.

Flood Studies Led to National Flood Insurance. Edelen, G.W., Jr.; Ferguson, G.E.; and Langbein, W.B. U.S.G.S., Water Resources Division, Reston, Virginia. Civil Engineering-ASCE (February 1979), pp.89-91.

Data provided by the U.S.G.S. has played a major role in public efforts to deal with flood hazards. Those efforts have generally changed from construction works to land-use regulations and, especially, the National Flood Insurance Program.

The National Flood Insurance Program: Some Midstream Perspectives. Platt, R.H. Department of Geography and Department of Law, University of Massachusetts, Amherst. Journal of the American Institute of Planners 43 (1976), pp. 303-313.

History, overview, and implementation of the National Flood Insurance Program are discussed. Four major issues -- constitutionality, mapping, insurance rates, and federal regulations -- stand in the way of the program. Resolutions are offered.

Federal Disaster Assistance -- Program Guide. HUD-370-FDAA (3), Washington, D.C. 1976.

A Unified National Program for Floodplain Management. U.S.Water Resources Council, Washington, D.C. 1976.

Federal Disaster Assistance -- Program Guide. HUD-370-FDAA(3), Washington, D.C. 1976.

FLOOD: Are you protected from the Next Disaster? National Flood Insurance Program. Bethesda, Maryland. 1981.

## III. GENERAL INFORMATION AND OTHER SOURCES

Cooperative Flood Loss Reduction: A Technical Manual for Communities and Industry. Owen, H. James, Flood Loss Reduction Associates, Palo Alto, California. For SEDA-Council of Governments and U.S. Water Resources Council, Washington, D.C. U.S. Government Printing Office. 1981.

> Sources of assistance in planning and carrying out various loss reduction measures are identified and selected references are listed.

Floodplain Management Handbook. Owen, H. James, and Wall, Glenn P. Flood Loss Reduction Associates, Palo Alto, California. For U.S. Water Resources Council, Washington, D.C. U.S. Government Printing Office. 1981.

> Provides step-by-step guidance for developing a floodplain management program. Identifies the range of technical and financial assistance available for preparing and implementing such programs.

A Perspective on Flood Plain Regulations for Flood Plain Management. Kusler, J.A., Dr. U.S. Department of the Army, Office of the Chief of Engineers, Washington, D.C. 1976.

> Many of the issues concerning floodplain regulations are addressed.

Guidelines for Flood Damage Reduction. Army Engineer District, Sacramento, California. U.S. Government Printing Office. 1977.

> Conventional (structural) and nonconventional (building restrictions) measures of floodplain management are identified.

Regulation of Flood Hazard Areas to Reduce Flood Losses. Volume Two, Part V-VI. U.S. Water Resources Council, Washington, D.C. U.S. Government Printing Office. 1973.

> State and local governments should regulate land and water areas to reduce flood losses.

State Flood Plain Management Activities. Johnson, J.G. State Water Resources Board, Salem, Oregon. ASCE J Hydraulics Division 96 (1970).

> The Tennessee Valley Authority pioneered comprehensive floodplain management. Activities in ten states exemplify the concept's evolution. They work primarily to identify floodplains and help local agencies to manage them.

Guide for Flood and Flash Flood Preparedness Planning. Department of Commerce, Washington, D.C. 1970.

Water and Environmental Quality. Oregon State University, Corvallis. Water Resources Research Institute fall seminar, 1967. 1968.

Oregon's water resource problems are discussed and general solutions are offered. Topics include floodplain management, pollution, legislation, and forestry.

A Process for Community Flood Plain Management, Summary Report. Leman Powell Associates, Inc., Alexandria, Virginia. National Technical Information Service PB81-185282. Office of Water Research and Technology report OWRT TT/80, Washington, D.C. 1980.

Promising methods for managing floodplains, including a combination of various methods, preservation of resources, the nature of floods, economic and social impacts, federal law, and assistance to communities are addressed.

A Process for Community Flood Plain Management. Leman Powell Associates, Inc., Alexandria, Virginia. Office of Water Research and Technology, Washington, D.C. 1979.

Guidelines for floodplain management address the combination of structural and nonstructural methods. Planning in general, as well as a variety of management techniques, are discussed.

Flood Plain Management Information Report, New York. Army Engineer, District, Buffalo, New York. 1972.

State and local agencies are advised on how to identify flood endangered areas. Encourages flood management.

Annotations of Selected Literature on Nonstructural Flood Plain Management Measures. Owen, H. James. Palo Alto, California. 1977.

A comprehensive literature review concerning nonstructural measures for floodplain management is presented. The economic, social, institutional, and legal consequences of such measures, as opposed to structural ones, are hard to determine. This bibliography, with subject index, will aid in literature searches.

Flood Plain Management and Implementation Strategies for FPM Programs. Dougal, Merwin D.; Rossmiller, Ronald L.; and Austin, T. Iowa State Water Resources Research Institute, Ames; Office of Water Research and Technology, Washington, D.C.; University of Wisconsin, Madison; Water Resources Center, University of Nebraska, Lincoln; Water Resources Research Institute; and Missouri River Basin Water Institute Consortium. 1974.

Representatives to a Midwest workshop identified and discussed research needs in floodplain management. Land use, engineering, economics, and politics were discussed. Procedures and regulations for Iowa and Illinois are included.

Local Assistance Series: 1A - Floodplain Publications. Army Engineer District, Chicago, Illinois. Illinois Department of Transportation, Chicago. 1980.

Abstracts describe publications concerning floodplain management.

Local Assistance Series: 1B - Directory of Floodplain Agencies. Army Engineer District, Chicago, Illinois. January 1980.

Federal, state, and regional agencies available to local governments and citizens seeking help with flood-related problems are listed.

Flood Damage Prevention: An Indexed Bibliography. Water Resources Research Center, University of Tennessee, Knoxville. 1976.

Bibliography emphasizes flood insurance, floodproofing, and nonstructural methods for reducing flood damage. A few selections concern structural flood control.

North Dakota Floodplain Management: Bibliography. Fahy, Vernon. North Dakota State Water Commission, Bismarck. 1981.

Bibliography lists available information on flooding and flood management. Eight subject headings are used.

Floodplain Management: Iowa's Experience. Papers presented at Conference on Floodplain Management, Iowa State University, Ames. Dougal, M.D. ed. Iowa State University Press, Ames. 1969.

Conference presentations deal with the philosophy and necessity of floodplain management; present and future problems in Iowa; the planning,implementing, and legality of management; and successes in other states.

Land Use Controls in Floodplain Management. Dzurik, Andrew A. Florida State University, Tallahassee. J Environmental Systems 8 (1978 -1979), pp. 253-265.

Since the nineteenth century, floodplain management in the U.S. has evolved from a local responsibility, focusing on structural flood control, to a complex public responsibility concerned with land-use management.

Floodplain Management in Project Planning. Haugh, J.S. Soil Conservation Service, Washington, D.C. ASCE79-2580. St. Joseph, Michigan. 1979.

Any flood control plan must consider future land use. If proper land use can be assured, floods need not be confined to a single channel. Also care must be taken to consider the infrequent, but unusually severe, storm.

Practices and Problems in Floodplain Management. Tucker, L. Scott. In "Proceedings of the Engineering Foundation Conference on Improved Hydrological Forecasting--Why and How?" pp. 333-341. ASCE, NewYork. 1980.

Floodplain management practices and problems are discussed, including federal flood insurance, federal commitment and authorization, urbanization, land acquisition, financing, maintenance, and public awareness.

Floodplain Management Must Be Ecologically and Economically Sound. Goddard, J.E. Civil Engineering ASCE 41 (1971).

Despite massive construction efforts, flood losses have increased in the United States over the last 35 years. There are often ecologically advantageous solutions; various federal measures aim in that direction. Developers, engineers, and ecologists must work together, and consider more than just money.

Policy Toward Floodplain Management. Water Resources and Marine Sciences Center, Cornell University, Ithaca, New York. In "Conflicts in Water Resources Planning: Water Resources Symposium No. 5," pp. 62-76. University of Texas Center for Research on Water Resources, Austin. 1972.

Conflicts over flood control plans have led to inequitable decisions, lost time and energy, new innovations, and broader interest in decision-making processes. We need to combine various flood control strategies and, thus, create broader coalitions to support them.

Guidelines for Flood Damage Reduction. Army Engineer District, Sacramento, California. 1976.

Local governments manage floodplains separately or in conjunction with management of floodwaters. Conventional methods change floodplain landscapes; unconventional ones regulate floodplain development. Many alternatives for both are described.

Floodplain Management, Administrative Rules and Regulations. Montana Department of Natural Resources and Conservation, Helena. 1980.

A Perspective on Floodplain Regulations for Floodplain Management. Department of the Army, Office of the Chief of Engineers, Washington, D.C. 1972.

Floodplain Management Guidelines For Implementing E.O. 11988. U.S. Water Resources Council, Federal Register 43FK 6030, Washington, D.C. 1978.

Floods of 1972. General Adjustment Bureau, Inc., New York.

Implementation of Non-Structural Alternatives in Flood Damage Abatement. Proceedings of a conference on informational and research needs. Durham, New Hampshire. 1976.

Floodplain Information Survey. Floodplain Information Repository, Urbana, Illinois.

Natural Disaster Recovery and Mitigation Resource Referral Service. The Resource Referral Service, The Academy for Contemporary Problems, Washington, D.C.

Annotations of Selected Literature on Nonstructural Floodplain Management Measures. HEC, U.S. Army Corps of Engineers, Davis, California. March 1977.

A Perspective on Floodplain Regulations for Floodplain Management. Department of the Army, Office of the Chief of Engineers, E1165-2-304, Washington, D.C. June 1976.

Natural Disaster Recovery and Mitigation Resource Referral Service. The Resource Referral Service, The Academy for Contemporary Problems, Washington, D.C.

## IV. LEGAL AND SOCIAL ISSUES

Flood Plain as a Residential Choice, Resident Attitudes and Perceptions and Their Implications to Flood Plain Management Policy. James, L.D.; Laurent, E.A.; and Hill, D.W. Environmental Resource Center Institute of Technology, Atlanta. Report 0671. 1971.

> Residential settlement of floodplains is analyzed with regard to residents, developers, and government agencies. A model describes how residents choose a site, react to floods, and expect government help.

Water Law--Act of God Defense--Flood Damage from Reservoir Overflow. Sanford, K.T. Denver Law Journal: 50 (1973), pp. 381-388.

> When damages result from the overflow of a reservoir, Colorado statute provides for absolute liability. A recent Colorado court decision states that flooding not foreseeable by reasonable engineering techniques may be an "act of God" for legal purposes. The statute is preferable.

Legal Aspects of Flood Plain Management. Campbell, William A., and Health, Milton S., Jr. North Carolina Water Resources Research Institute, Raleigh; Institute of Government, University of North Carolina at Chapel Hill; and Office of Water Research and Technology, Washington, D.C. 1979.

> The federal flood insurance program requires participating communities to adopt various land-use restrictions. The North Carolina Floodway Act, which authorizes such regulation, is deficient in scope and terminology. Solutions are suggested.

Assessment of Flood Management Alternatives Against Social Performance Criteria, Phase II Report. Mack, R. Institute of Public Administration, New York. National Technical Information Service PB-249543. 1975.

> After studying the effects of various flood management strategies, a framework was developed for evaluating their social impacts on an equal basis with environmental and economic impacts.

Criteria for Evaluation of Social Impacts of Flood Management Alternatives. Mack, R. Institute of Public Administration, New York. National Technical Information Service PB-238 496. 1974.

> Social impacts of floods and flood management measures do not readily fit into the usual cost/benefit analysis. Case studies are used in a system similar to cost/benefit analysis, but not based strictly on financial terms.

Amortization of Nonconforming Uses in Floodplains. Walker, William R. Water Resources Research Center, Virginia Polytechnic Institute, Blacksburg. Journal of the Urban Planning and Development Division, ASCE 96 (1970), pp. 1-16.

Most courts uphold zoning ordinances with provisions to remove nonconforming uses through amortization. Amortization is the best method in the case of floodplains. Prevelant court theories and commonly cited cases are described.

V. MANAGEMENT METHODS AND TECHNICAL INFORMATION

Flood Hazard Mitigation, Handbook of Common Procedures. Regional Interagency Hazard Mitigation Team. FEMA, Washington, D.C. U.S. Government Printing Office. 1981.

Mitigation for reducing flood damage losses is described. Nonstructural measures have an important role alongside structural measures.

Physical and Economic Feasibility of Nonstructural Flood Plain Management Measures. Johnson, W.K. U.S. Army Corps of Engineers, Washington, D.C. Hydrologic Engineering Center and Institute for Water Resources, Department of the Army, Office of the Chief of Engineers, Washington, D.C. 1978.

Flood Emergency and Residential Repair Handbook. Anderson, C.M., and Anderson, P.E., FEMA-FIA, Washington, D.C. U.S. Government Printing Office. 1979.

Procedures for dealing with flood hazards and damages to homes and their contents are described.

Effect of Transportation Planning on Flood Plain Management. Lee T.M. Wisconsin Department of Natural Resources, Madison. ASCE J Hydraulics Division 98 (1972), pp. 475-488.

Standards are explained and floodplain management programs are developed. Special attention is paid to transportation systems.

Economic Feasibility of Floodproofing--Analysis of a Small Commercial Building. HUD-508-FIA, Washington, D.C. 1979.

Elevated Residential Structures--Reducing Flood Damage through Building Design: A Guide Manual. HUD-FIA, Washington, D.C. 1976.

Introduction to Flood Proofing. Sheaffer, John R. William J.; Gold, Phillip; Hackett, James E.; and Lewis, Richard. University of Chicago Center for Urban Studies. 1967.

Principles of floodproofing are explained, as are several simple measures for securing buildings against flood damage.

Conservation Impacts and Practices of Sand Removal from Dry Bed Oklahoma Rivers. Harp, J., and Chang, R.C. Oklahoma State University, Stillwater. National Technical Information Service PB81-124158. Oklahoma Water Resources Research Institute, Oklahoma State University, Stillwater. 1980.

Knowing the prior morphology and hydraulics of a river system can help planners predict its response to sand mining. Generally, flow speed decreases and capacity increases near the mine. Too much mining may have adverse, long-term effects. But mining according to certain guidelines may even help floodplain management.

Tests of Brick-Veneer Walls and Closures for Resistance to Floodwaters. Pace, Carl E. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. 1978.

Limited tests show that the common brick-veneer wall can be made to support any reasonable depth of water.

Flood Proofing Rural Residences, A Project Agnes Report, Pennsylvania. Black, Richard D. Department of Agricultural Engineering, New York State College of Agriculture and Life Sciences, Ithaca. Economic Development Administration, Office of Technical Assistance, Washington, D.C. 1975.

The Economic Development Administration and the U.S. Office of Water Resources Research funded a multidisciplinary study of flood management. Structural problems of flood-proofing houses are discussed.

The Regulatory Floodway in Flood Plain Management: Technical Report. Minnesota Department of Natural Resources, Division of Water, Floodplain Management, St. Paul. 1977.

The "floodway" concept of floodplain management is described.

Management Problems in Floodplain Areas. Lee, Thomas M. Floodplain and Shoreland Management Program, Madison, Wisconsin. ASCE J Water Harbors Coastal Engineering Division 98 (1972), pp. 357-373.

Floodplain management should be part of an overall national or state land-use policy, not an isolated effort just to prevent flood damage. Revising land taxation would help floodplain management.

Legal Problems in Regulating Flood Hazard Areas. Linebman, Ernst. National Water Commission, Washington, D.C. ASCE J Hydraulics Division 99 (1973), pp. 2113-2123.

Effective floodplain management requires both structural and nonstructural measures. Legislated restrictions on land use are an effective nonstructural method.

Physical and Economic Feasibility of Nonstructural Floodplain Management Measures, 1978. Johnson, William K. Hydrological Engineering Center, Davis, California. U.S. Government Printing Office. 1978.

Eleven common, nonstructural measures for floodplain management are examined. Physical and economic feasibility of the different measures are evaluated, and the advantages of each measure are summarized.

Land Use Management: An Economic Necessity. James, L. Douglas. University of Kentucky, Lexington. Water Resources Research Center, Virginia Polytechnic Institute, Blacksburg.

Fxcessive restrictions can hamper economic growth. However excessive development can lead to severe damage. Flood management, therefore, should emphasize best, rather than least, use. In flood management, landowners' nonstructural methods and communities' structural metnods can be made to work together.

Nonstructural Methods of Floodplain Management, Identification, Evaluation, and Selection. Fraser, William Eugene. Landscape Architecture Thesis, University of Illinois, Urbana. 1970.

Nonstructural methods of floodplain management are described and evaluated, and a selection process is developed. Nonstructural methods include protection, education, and regulation measures.

Flood Hazard Reports: Tools For Resource Planning and Management. Ringler, T.A., and, Kennaugh, J.H. Soil Conservation Service, Grand Rapids, Michigan. Journal of Soil and Water Conservation 29 (1974), pp. 182-185.

Reports concerning floodplain boundaries and soil types, including maps, interpretive data, and soil descriptions, can provide a technical basis for local floodplain management. Various management methods are suggested.

Floodplain Planning in Urban Areas. Pfeiffer, F.N. San Antonio River Authority. In "Proceedings of the 16th Annual Conference on Water for Texas," Urban Water Resources Planning and Management, pp. 75-83.Texas Water Resources Institute, San Antonio. 1971.

Floodplain management, essential to both congested and undeveloped urban areas, must consider both floodplain corridors and adjacent areas. Such management necessarily involves regulation, zoning, and maintenance.

In The Event of a Flood: Suggestions to Help Minimize the Loss of Life and Property. National Flood Insurance Program, Bethesda, Maryland.

Guidelines For Determining Flood Flow Frequency. The Hydrology Committee, United States Water Resources Council, Washington, D.C. 1978.

Manual for the Construction of Residential Basements in Noncoastal Flood Environs. HUD-FIA-285, Washington, D.C., 1978.

Floodproofing Regulations. Department of the Army, Office of the Chief of Engineers, Washington, D.C. 1972.

VI. MONTANA

Western Unit Flood Protection Project, Billings, Montana (Draft Environmental Impact Statement). Army Engineer District, Omaha, Nebraska. National Technical Information Service PB-204 575D. 1971.

This diversion project will reroute flood flows from irrigation and natural drainages, thus protecting Billings from a standard flood. Annual benefits total $159,000; average costs, $5,000. Sixty-six acres of farmland will be lost, and stream turbidity will temporarily increase.

Carbon Hill Watershed, Custer County, Montana (Final Environmental Impact Statement). Soil Conservation Service, Washington, D.C. National Technical Information Service EIS-MT-72-4862-F. 1972.

This 287-acre project consists of land treatment measures, four reservoirs, and floodway systems for a 5,950 acre watershed. It will reduce sediment and pollution damage downstream and provide habitat for waterfowl.

Western Unit Flood Protection Project, Billings, Montana (Final Environmental Impact Statement). Army Engineer District, Omaha, Nebraska. National Technical Information Service PB-204 575-F. 1972.

This diversion project will reroute flood flows from irrigation and natural drainages, thus protecting Billings from a standard flood. The project will remove sixty-six acres of irrigated land from agricultural production, destroy some wildlife habitat, and temporarily increase erosion.

Jefferson River at Three Forks, Montana (Final Environmental Impact Statement). Army Engineer District, Omaha, Nebraska. National Technical Information Service PB-208 296-F. 1971.

This 14,700-foot levee, constructed from nearby river alluvium, will protect Three Forks from the 100-year floods. The levee will cover twenty acres of land, temporarily remove wildlife cover, and may provide a collector for pollution.

Baker Lake Watershed Project, Fallon County, Montana (Final Environmental Impact Statement). Soil Conservation Service, Bozeman, Montana. National Technical Information Service EIS-MT-1327-F. 1973.

A floodwall will protect Baker Lake and the city of Baker, in southeastern Montana, from flood damage. One hundred and eighty-four acres, mostly semiarid rangeland, will be distributed by the project, which was chosen over many other alternatives. The public and government generally favor the project.

Flood Plain Management In Montana. Parrett, C. Floodway Management Bureau, Montana Department of Natural Resources and Conservation, Helena. In "Hydraulic Engineering and the Environment: Proceedings of the 21st annual Hydraulic Division Specialty Conference," pp. 85-91. ASCE, New York. 1973.

Floodplain management has just begun in Montana. Its floodplain law is based on working programs in Nebraska and elsewhere, and seems generally effective. The program, however, faces two major problems. Floodplains often are developed faster than data necessary to manage them can be supplied. Also, the public often opposes land-use regulations.

Stillwater River and Rosebud Creek Flood Hazard Analyses, Stillwater County, Montana. Soil Conservation Service, Bozeman, Montana. 1974.

Knowledge of flood hazards can aid floodplain management and so reduce flood damage. Sixteen aerial photomaps and other data describe flood areas, surface water, and soils.

Floodway Management and Regulation. Montana Revised Codes, sections 89-3501 through 89-3515 (Supp. 1975).

The Montana Floodway Management Regulation Act guides the development of flood areas. It authorizes the state to delineate flood areas throughout the state and requires local governments to adopt land-use regulations that meet minimum state standards.

Floods of June 1964 in Northwestern Montana: Geological Survey Water-Supply Paper 1840-B. Boner, F.C., and Stermitz, Frank. USGS, Washington, D.C. U.S. Government Printing Office. 1967.

Hydrologic data for detailed planning of flood management efforts, especially in northwestern Montana, are presented.

Annual Peak Discharges from Small Drainage Areas in Montana through September 1977. Omong, R.J., and Hall, J.A. Water ResourceDivision, USGS, Helena, Montana. 1978.

The changing magnitude and frequency of floods in small Montana drainages from 1955 to 1977 are described.

Montana Floodplain Management, Questions and Answers. Montana Cooperative Extension Service. Bulletin 1096. Bozeman. 1972.

Interim Report on the Frequency and Magnitude of Floods in Eastern Montana. USGS. 1963.

Magnitude and Frequency of Floods From Drainage Areas of Less Than 100 Square Miles in Montana. USGS. 1967.

Special Flood Hazard Information Report: Cottonwood Creek, Deer Lodge, Montana. U.S. Army Corps of Engineers. 1972.

Floodplain Information: Beaverhead River, Dillon, Montana. U.S. Army Corps of Engineers. 1975.

Report of East Gallatin River and Upper Tributaries: Flood Hazard Analysis, Gallatin County, Montana. Soil Conservation Service, Bozeman, Montana. 1972.

Special Flood Hazard Information Report: Gallatin River, Gallatin County, Montana. Army Engineers District, Seattle, Washington. 1973.

Flood Insurance Study: Town of Three Forks, Gallatin County, Montana. FEMA-FIA. 1980.

Flood Insurance Study: Town of Troy, Lincoln County, Montana. FEMA-FIA. 1980.

Floodplain Information, Alkali Creek, Billings Metropolitan Region. U.S. Army Corps of Engineers. 1969.

Floodplain Information, Stillwater and Whitefish Rivers, Kalispell-Columbia Falls, Montana. U.S. Army Corps of Engineers. 1969.

Floodplain Information, Sun River, Great Falls, Montana. U.S. Army Corps of Engineers. 1973.

Floodplain Information, Yellowstone River, Billings Metropolitan Region, Montana. U.S. Army Corps of Engineers. 1969.

Discussion Paper on Missouri River Basin Floodplain Management: An Analysis of Executive Order 11988 and Optional Policies. Missouri River Basin Commission, Omaha, Nebraska. 1978.

Flood Insurance Study: Cascade County, Montana--Unincorporated Areas. FEMA-FIA. 1979.

Flood Insurance Study: City of Belt, Cascade County, Montana. HUD-FIA. 1979.

Flood Insurance Study: City of East Helena, Lewis and Clark County, Montana. FEMA-FIA. 1979.

Flood Insurance Study: City of Glendive, Dawson County, Montana. FEMA-FIA. 1980.

Flood Insurance Study: City of Great Falls, Cascade County, Montana. HUD-FIA 1977.

Flood Insurance Study: City of Kalispell, Flathead County, Montana. FEMA-FIA. 1980.

Flood Insurance Study: City of Miles City, Custer County, Montana. FEMA-FIA. 1979.

Flood Insurance Study: Lincoln County, Montana--Unincorporated Areas. FEMA-FIA. 1980.

Flood Insurance Study: Butte-Silver Bow, Montana. FIA. 1979.

Flood Insurance Study: Granite County, Montana--Unincorporated Areas. FEMA-FIA. 1981.

Flood Insurance Study: Missoula County, Montana--Unincorporated Areas. FEMA-FIA. 1981.

Flood Hazard Analysis: Rosebud Creek Tributaries, Stillwater County, Montana. Soil Conservation Service. 1975.

Flood Insurance Study: Sweet Grass County, Montana--Unincorporated Areas. FEMA-FIA. 1981.

Flood Insurance Study: Town of Drummond, Granite County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: Town of Philipsburg, Granite County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: Town of Denton, Fergus County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: Town of Moore, Fergus County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: City of Lewistown, Fergus County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: Gallatin County, Montana--Unincorporated Areas. FEMA-FIA. 1981.

Flood Insurance Study: Town of Lima, Beaverhead County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: City of Dillon, Beaverhead County, Montana. FEMA-FIA.1981.

Flood Insurance Study: Beaverhead County, Montana--Unincorporated Areas. FEMA-FIA. 1981.

Flood Insurance Study: City of Helena, Lewis and Clark County, Montana. FEMA-FIA. 1981

Flood Insurance Study: Lewis and Clark County, Montana--Unincorporated Areas. FEMA-FIA. 1981.

Flood Insurance Study: Carbon County, Montana--Unincorporated Areas. FEMA-FIA. 1981

Flood Insurance Study: City of Harlowton, Wheatland County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: Wheatland County, Montana--Unincorporated Areas. FEMA-FIA. 1981.

Flood Insurance Study: City of Whitefish, Flathead County, Montana. FEMA-FIA. 1979.

Flood Insurance Study: City of Red Lodge, Carbon County, Montana. FEMA-FIA. 1981

Flood Insurance Study: Town of Eureka, Lincoln County, Montana. FEMA-FIA. 1979.

Flood Insurance Study: City of Billings, Yellowstone County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: City of Libby, Lincoln County, Montana. FEMA-FIA. 1979.

Flood Insurance Study: City of Deer Lodge, Powell County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: Town of Fromberg, Carbon County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: Yellowstone County, Montana--Unincorporated Areas. FEMA-FIA. 1981.

Flood Insurance Study: Powell County, Montana--Unincorporated Areas. FEMA-FIA. 1981.

Flood Insurance Study: Town of Lavina, Golden Valley County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: Golden Valley County, Montana--Unincorporated Areas. FEMA-FIA. 1981.

Flood Insurance Study: Town of Lodge Grass, Bighorn County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: Big Horn County, Montana--Unincorporated Areas. FEMA-FIA. 1981.

Flood Insurance Study: Town of Joliet, Carbon County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: City of Bozeman, Gallatin County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: Ravalli County, Montana--Unincorporated Areas. FEMA-FIA. 1982.

Flood Insurance Study: City of Missoula, Missoula County, Montana. FEMA-FIA. 1982.

Flood Insurance Study: Fergus County, Montana--Unincorporated Areas. FEMA-FIA. 1982.

Flood Insurance Study: Town of Grassrange, Fergus County, Montana. FEMA-FIA. 1981.

Flood Insurance Study: City of Laurel, Yellowstone County, Montana. FEMA-FIA. 1981.

VII. PLANNING AND EVALUATION METHODS

Management of Flooding in a Fully Developed, Low-Cost Housing Neighborhood. Novoa, Jose I., and Halff, Albert H. Albert H. Halff Associates, Inc., Dallas, Texas. Water Resource Bulletin 13 (1977), pp. 1237-1252.

> Eight alternatives for flood management are evaluated for safety, social effects, and economic cost. Streamside parks and open spaces are preferred.

Dealing With Variable Flood Hazard. McCrory, Jerry A.; James, L. Douglas; and Jones, D. Earl, Jr. U.S. Army Corps of Engineers, Fort Worth, Texas. J Water Resources Planning Management Division ASCE 102 (1976), pp. 193-208.

> Curves for managing floodplains on the basis of equal exposure to damage are developed by considering the frequency of flood stages and the relative damage they cause. Acceptable exposure to damage is judged in relation to fire insurance, property taxes, and returns on investment.

A Regional Planning Approach to the Floodplain Management Problem. Weisz, R.N., and Day, J.C. Department of Agricultural Economics, University of Arizona, Tucson. Annals of Regional Science IX (1975), pp. 80-92.

> The Floodplain Management System, a simple, straightforward method for evaluating flood management programs, focuses on the cost efficiency of combined structural and nonstructural programs. The system was tested in Pima County, Arizona.

Hydrologic Extreme Value Model and Risk Analysis Applied to Flood Plain Management. Ashkar, F.; El-Jabi, N.; and Rouselle, J. Ecole Polytechnique, Montreal, Quebec Department of Civil Engineering. In"Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction." Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No. 2, pp. 432-446. 1980.

> Development may be regulated, and insurance risks computed, by dividing floodplains into zones. A mathematical model will compute insurance risks based on flood frequency and level.

Estimating Costs and Benefits for Nonstructural Flood Control Measures. Carson, William D. University of California at Davis. 1975.

> The economic effects of flood-proofing, evacuation/relocation, and land-use regulation are evaluated.

National Economic Development Benefits for Nonstructural Measures. Carson, William D. Hydrologic Engineering Center, Davis, California. 1980.

National benefits for nonstructural measures of flood management are discussed. Economic concepts, interpretations of regulations, summary tables, and narrative and tabular examples are provided.

A Computer Simulation Model for Flood Plain Development, Part II, Model Description and Application. Arvanitidis, N.V.; Rosing, J.; Petropoulos, D. P.; Jolissaint, C.H.; and Poage, J.L. Intansa, Menlo Park, California. 1972.

The economic efficiency of various flood management programs is evaluated through a simulation model. The model calculates flood damages, allocates land uses, and calculates benefits of management.

Preliminary Review and Analysis of Flood Control Project Evaluation Procedures. Arvanitidis, N.V.; Lind, R.L.; Rosing, J.; and Johnson, G.P. Intansa, Menlo Park, California. 1972.

To assess the economic affect of floodplain management, one must carefully determine the net increase in productivity brought about by a project when the project's benefit is the difference in productivity with and without the project.

Flood Plain Management Through Allocation of Land Uses--A Dynamic Programming Model. Hopkins, Lewis D.; Brill, E. Downey, Jr.; Liebman, Jon C.; and Wenzel, Harry G., Jr. Urbana Water Resource Center, University of Illinois--Urbana-Champaign. Office of Water Research and Technology, Washington, D.C. 1976.

Reducing flood damage requires better patterns of land use. A dynamic programming model shows the best combination of land uses, both upstream and downstream.

Flood Plain Mapping Using Computer Graphics. GKY and Associates, Inc., Springfield, Virginia. For the Office of Water Research and Technology, Washington, D.C. National Technical Information Service PB81-231870. 1981.

A computer program developed by the Corps of Engineers was adapted to provide computer graphics that would help specify flood areas. The study included, among other things, writing user manuals and conducting demonstrations.

Optimal Mix of Adjustments to Floods. Morin, T.L.; Meier, W.L., Jr.; and Nagaraj, K.S. School of Industrial Design, Purdue University, Lafayette, Indiana. National Technical Information Service PB81-240533; Purdue University Water Resources Research Center Technical Report No. 139. 1981.

Dynamic computer programming can help determine the best combination of structural and nonstructural methods for a given flood management task.

A Methodology for Floodplain Development and Management. TRW Systems Group, Redondo Beach, California. National Technical Information Service AD-704 716, Army Engineer Institute for Water Resources, IWR Report 69-3. Department of the Army, Chief of Engineers, Washington, D.C. 1969.

A method commonly known as trade-off analysis evaluates the economic consequences of various alternatives for floodplain management. Case studies are included.

A Methodology for Planning Land Use and Engineering Alternatives for Floodplain Management. Weisz, R.N. Ann Arbor, Michigan. University Microfilms, 48106 (Order No 74-2013). Ph.D. Dissertation. 1973.

Methods for analysis and decision making can determine the least expensive method of floodplain management. A computer makes rules for combining various engineering and land-use alternatives.

Scenario Methodology in Natural Hazards Research. Ericksen, N.J., Program on Technology, Environment, and Man, Institute of Behavioral Science, University of Colorado, Boulder. National Technical Information Service PB-262 024. 1975.

Scenario methods and interconnections within natural hazard relief systems are studied. Management alternatives for local communities, particularly Boulder, Colorado, are suggested, especially in regards to flood control.

Economic Analysis of Alternative Flood Control Measures. James,L. Douglas. Kentucky Water Resource Institute, Lexington. Office of Water Research and Technology, Washington, D.C. 1968.

Executive Order 11296 requires federal agencies to seek the best combination of structural and nonstructural flood management measures. Two digital computer programs assess the alternatives. Computer analyses must be followed by field work.

Economic Analysis of Floodplain Management Alternatives. Wichie. Montana Department of Natural Resources and Conservation, Helena. 1974.

## OTHER RESOURCES

### FILMS

Available from: FEMA, Building 710, Denver Federal Center, Lakewood, Colorado 80225.

1. "Planning for Floods."
2. "It Didn't Have to Happen."
3. "Watch Along the Watershed."

### SLIDE SHOWS

Available From: Librarian, Missouri River Basin Commission, Suite 403, 10050 Regency Circle, Omaha, Nebraska, 68114.

Selected Floodplain Management Documents Available Through the Montana State Library, Helena, Montana.

1. "Floodplain Management Techniques."
2. "Steps in Floodplain Management."
3. "Intergovernmental Management of Floodplains."
4. "Floodplain Management."
5. "Early Flood Warning."

Included in each program are a set of slides (numbered in order) and a typed script with slide cues noted. Programs vary in length from 10 to 20 minutes.

The programs were produced by the U.S. Water Resources Council and are available at no charge.